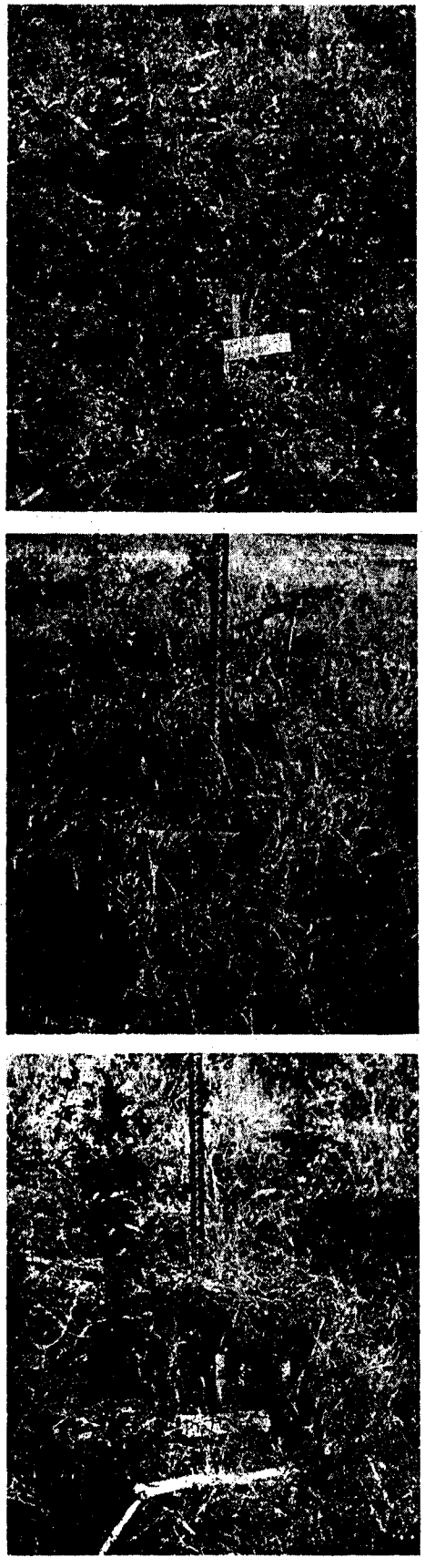

Coastal bermudagrass growth was negligible on the turnplow-tilled plots (top), but a significant amount of grass was available for grazing after corn harvest on the lister-plant (center) and rip-plant (bottom) areas.

The Compatability of Corn and Coastal Bermudagrass as Affected by Tillage Methods

Data presented in this article reveal that corn and Coastal bermudagrass may be successfully produced simultaneously on the same area of land in the Southeast. Yields from corn planted in Coastal bermudagrass with minimum tillage methods are similar to yields obtained when conventional tillage methods are used. Grass yields after corn harvest from areas subjected to minimum tillage methods are significantly larger than the yields from conventionally-tilled areas.

BY O. W. BEALE
AND G. W. LANGDALE

GROWING corn and other row crops in live grass sods has been considered a dubious practice, but Coastal bermudagrass and corn have been grown simultaneously with satisfactory results. Conventional turnplow tillage and intensive cultivation of corn could reduce or completely eradicate Coastal bermudagrass, but minimum tillage methods for corn production that permit retention of sufficient live grass to reestablish the sod have been developed.

Various types of minimum tillage that involve complete turn-plowing of the sod as the initial operation have been adequately described by several investigators (*2, 3, 5, 6, 10*). Moody and his coworkers (*8*) killed a sod of fescue, orchard-grass and clover with Atrazine[1] and planted corn in the undisturbed dead sod. They reported that yields from plots on this area were not different from yields obtained on turn-plow tilled plots. Free and his associates (*4*) used a mixture of Atrazine and aminotriazole to kill alfalfa before producing corn under "zero tillage". Differences between yields of the zero- and conventionally-tilled corn were not significant.

Poynor (*9*) developed an experimental mulch planter that prepared the seedbed, distributed fertilizer, and planted corn in one operation. With this machine, he planted corn in an alfalfa-brome sod, leaving a 10-inch balk between rows for mulch. He reported that yields of mulch-tilled corn were comparable to those of conventionally-tilled corn.

McAlister (*7*) conducted a number of field trials in the Southeast in which corn, soybeans, sorghum, millet, and other crops were planted in grain stubble and sod and on land moderately infested with noxious weeds. He used a modified lister planter to prepare the seedbed, distribute fertilizer, plant the crop, and apply herbicides in one operation. The planting furrow, opened with the rotary disk and middlebuster-type lister plow, was about 12 to 14 inches wide and 3 to 4 inches deep. Soil from this furrow was bedded 1 to 2 inches deep between the planted rows. The bedded soil was plowed into the planting furrow when the corn was cultivated, uncovering the sod crop or plant residues. Lister planting (or mulch tillage, as the procedure is generally known in the Southeast) was facilitated by reducing the size of the residue crops with a straw chopper or rotary mower before planting. McAlister indicated that conservation of moisture, improved soil tilth, reduced runoff and erosion from sloping lands, better utilization of plant residues, and lower time and labor requirements were advantages favoring lister planting as opposed to turnplowing.

Beale and his coworkers (*1*) evaluated the effects of mulch tillage of corn grown on Cecil sandy loam. Runoff and erosion were reduced and soil aggregation was increased under mulch tillage. The organic matter content and the total nitrogen content of the mulch-tilled soil were significantly greater than those of the turnplow tilled soil.

O. W. Beale and G. W. Langdale are research soil scientists associated with the Agricultural Research Service, U. S. Department of Agriculture. They are stationed at Florence, South Carolina.

This article is a contribution from the Soil and Water Conservation Research Division, Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the South Carolina Agricultural Experiment Station.

[1] 2-chloro-4-ethylamino-6-isopropylamino-s-triazine. Mention of the patented trade name is made solely to supply necessary information and does not imply endorsement of the product by the U. S. Department of Agriculture.

Reprinted from JOURNAL OF SOIL AND WATER CONSERVATION
Volume 19, Number 6, November-December, 1964

This article reports the results of an experiment designed to determine the compatibility of corn and Coastal bermudagrass as it is affected by various tillage methods.

Experimental Procedures

The experiment was conducted at the Pee Dee Experiment Station, a branch of the South Carolina Experiment Station at Florence, South Carolina. The soil was Dunbar sandy loam on slopes ranging from 0.5 to 1.0 percent. Each year, the tests were on different adjacent sites of Coastal bermudagrass sod established 4, 5, and 6 years before the corn was planted in 1961, 1962, and 1963. Each treatment was replicated four times in 1961, five times in 1962, and three times in 1963 in randomized complete blocks.

The Coastal bermudagrass was fertilized annually with 300 pounds of N, 11 pounds of P, and 150 pounds of K per acre. The grass was harvested for hay before the corn was planted. The corn was fertilized uniformly each year with 28 pounds of N, 37 pounds of P, and 70 pounds of K (700 pounds of 4-12-12) per acre at planting and with 100 pounds of N (300 pounds of ammonium nitrate) per acre as a sidedressing. The herbicide, 4 pounds of aminotriazole per acre, was applied in 21-inch bands when the grass had started growing. This was about 3 weeks before the corn was planted in 1961 and 1962.

Tillage methods tested were as follows:

1 Turnplow—turnplowed with moldboard plow, disk harrowed, smoothed by light disk harrowing, and planted and fertilized with conventional equipment in four separate operations. All of the surface soil was tilled.

2 Lister plant—lister-type planter, similar to that described by McAlister (7), used to open planting furrows, plant corn, and distribute fertilizer in one operation; aminotriazole applied in an additional operation. About 33 percent of the surface soil was tilled.

3 Rip plant—seedbed prepared for planting by ripping one or two times with a chisel-type field tiller 6 to 8 inches deep; corn was planted and fertilized with conventional equipment; either two or three operations. About 50 percent of the surface soil was tilled.

Total nitrogen in the first corn plant leaf below the lowest ear was measured by the Kjeldahl method during the pollination period.

Results and Discussion

The effects of tillage methods on yields of corn planted in Coastal bermudagrass sod are indicated by the data in table 1. The methods of tillage had no statistically significant effects on corn yields, but the 3-year average yield of the lister-planted corn was 7 bushels per acre less than that of corn grown on turnplowed plots. Aminotriazole depressed grass growth for 2 to 3 weeks after the corn was planted, but this did not significantly affect corn yields. However, in 1961 the yield from the lister planted plots treated with aminotriazole was 11 bushels per acre more than that from the lister planted plots not treated with the herbicide. The decrease in yields in 1962 and 1963 was due to drought periods in May and June of those years. The yield data in table 1 indicate that the lister- and rip-planting methods were as efficacious as the conventional turnplow tillage for producing corn in bermudagrass sods.

TABLE 1. Yields from Corn Planted in Bermudagrass Sod by Method of Tillage and by Years

Tillage Methods	*Corn Yields*[a]			
	1961	*1962*	*1963*	*Average*
	bushels per acre			
Turnplow	97	77	54	76
Lister plant	87	70	50	69
Lister plant[b]	98	70	—	—
Rip plant	91	81	55	75

[a]There were no significant differences at the 5 percent level of probability in the yields of corn produced under the various tillage methods during 1961 and 1963. The least significant difference at the 5 percent level of probability in yields of corn under the various tillage methods during 1962 was 9 bushels per acre.

[b]Aminotriazole applied in 21-inch band centered on row.

The average heights of the corn 1 and 3 months after emergence are recorded in table 2. Growth of the lister-planted corn plants was depressed early in the season. Examination revealed that the roots of the lister-planted corn had not developed as rapidly as those of the corn on the turnplow- and rip-planted areas and that they had not penetrated the zone of the banded fertilizer that was about 4 inches to the side and 2 inches below the corn seed.

The differences in root development during the month after emergence probably were due to the more compact soil in which the fertilizer was placed with the lister-plant method of tillage.

This condition could be partially alleviated by plowing more loose soil into the lister furrow or by loosening more soil in the furrow with a chisel plow attached to the lister plow bottom. The retarded growth and root development of the lister-planted corn were not reflected in yields significantly lower than those obtained with other tillage methods.

Data on total nitrogen in the corn leaves, corn plants lodged, and grass stands after corn harvest are given in table 3.

TABLE 2. Heights of Corn Plants Grown in Bermudagrass Sod by Months After Emergence and by Method of Tillage

Tillage Methods	*Corn Plant Heights*[a]	
	1 Month	*3 Months*
	feet	*feet*
Turnplow	1.21	11.80
Lister plant	0.96	11.00
Rip plant	1.14	11.20

[a]Least significant difference at the 5 percent level of probability in the height of corn plants under the various tillage methods 1 month after emergence is 0.16 feet; 3 months after emergence it is 0.61 feet.

The average nitrogen contents of corn grown under the various tillage treatments were not significantly different, but in 1962 the nitrogen content of the leaves of the lister-planted corn was significantly greater than that of the leaves of turnplow-tilled or rip-planted corn. Though grass growth was depressed to some extent by shading, the grass and corn were growing vigorously on the lister-plant and rip-plant areas when the leaves were sampled. However, grass growth on the turnplow-tilled areas was negligible. The data indicate that on all plots the supply of nitrogen was not critical for corn growth and was not limited by grass usage.

Moisture content of the soil at the 0- to 6-inch depth was determined at intervals during the growing seasons. The average moisture contents during 1962 ranged from 10.5 percent in the turnplow-tilled soil to 11.1 percent in the rip-planted area. Soil moisture measurements made on any one day were not substantially different, but moisture in the turnplow-tilled soil was usually slightly lower than that in the lister-plant and rip-plant soils. Between the rows, soil from the lister-plant furrow covered grass residues, which formed a moisture barrier between the bedded soil and the normal soil surface. The considerable amount of residue left on the soil surface by the rip-plant procedure reduced evaporation losses from the plots thus treated. The soil moisture data indicated that on all plots competition of the corn and grass for moisture was not severe.

TABLE 3. Total Nitrogen in Corn Leaves, Corn Plants Lodged, and Grass Stand After Corn Harvest, by Method of Tillage

Tillage Methods	*Nitrogen Content*[a]	*Plants Lodged*[b]	*Grass Stand*
	percent	*percent*	*stolons/10 ft.*
Turnplow	2.76	34	23
Lister plant	2.83	10	225
Rip plant	2.67	14	138

[a]Least significant difference at the 5 percent level of probability in nitrogen content of leaves of corn grown under various tillage methods is 0.20 percent.

[b]Least significant difference at the 5 percent level of probability in number of plants lodged under the various tillage methods is 18.

Average surviving corn stands under the various methods of tillage ranged from 13,400 to 13,900 plants per acre; differences among stands were not significant. Lodged plants (table 3), those either broken below the lowest ear or uprooted, were consistently more numerous on the turnplow-tilled area than on the lister- or the rip-plant plots. Neither the lister- nor the rip-plant corn was cultivated in 1963 but both were lightly cultivated once in 1961 and in 1962. The turnplow-tilled corn was cultivated with sweeps two times each year. The cause of excessive lodging of the turnplow-tilled corn was not determined; however, covering the base of the plants with soil during cultivation increased their susceptibility to soil-borne insects and diseases and these may have weakened the plants.

Since Coastal bermudagrass is propagated by stolon planting, an expensive and time-consuming process, retention of sufficient grass for sod reestablishment after the period of corn production is highly desirable. The grass stands retained, expressed as the number of stolons per 10 linear feet, are recorded in table 3. The grass was clipped at a height of approximately 5 inches after the corn was harvested. Relative yields under the turnplow, lister-plant and rip-plant tillage methods were 0.04, 0.31 and 0.20 ton of pure bermudagrass hay, respectively.

Though the amount of grass harvested from the turnplow area was negligible, sufficient grass was retained to reestablish the sod the following year. Yields of grass from the lister- and rip-plant areas indicate that considerable grazing could have been obtained after corn harvest. If corn were grown for silage, applications of nitrogen and potassium combined with the additional sunlight available to the grass after the silage was cut probably would increase the grass yield substantially. The aminotriazole treatment had no significant effect on corn yields, and the use of this or other chemicals to kill or retard the Coastal bermudagrass before planting corn in live bermudagrass sod by the lister-plant or rip-plant tillage methods might make it necessary to replant the grass.

Summary

The simultaneous production of corn and Coastal bermudagrass on the same area under a broad range of tillage methods indicated that these crops were compatible. Differences between yields of corn produced with minimum tillage methods (lister-plant and rip-plant) and yields under conventional turnplow tillage were insignificant. About one-third of the surface soil was disturbed by lister planting and one-half by rip planting. All of the surface soil was tilled under turnplow tillage.

Corn yields and the nitrogen contents of corn leaves indicated that the supply of nitrogen was not critical for corn growth and was not limited by grass usage. Moisture contents of the turnplow, lister-plant and rip-plant plots were not markedly different during the corn growing season.

Corn stands surviving under the different tillage methods were similar. Lodging of the turnplow-tilled corn was significantly greater than that of the lister-plant or rip-plant-tilled corn.

Grass yields after corn harvest from the rip- and lister-plant areas were significantly larger than those from the turnplow-tilled area; grass stand retention followed a similar pattern.

REFERENCES CITED

1. Beale, O. W., G. B. Nutt and T. C. Peele. 1955. *The effects of mulch tillage on runoff, erosion, soil properties and crop yields.* Soil Sci. Soc. Am. Proc. 19:244-247.
2. Bowers, Wendell, and H. P. Bateman. 1960. *Research studies of minimum tillage.* Trans. Am. Soc. Agr. Engr. 3:1-3.
3. Free, George R. 1960. *Minimum tillage for soil and water conservation.* Agr. Eng 41:96-103.
4. Free, George R., S. N. Fertig and C. E. Bay. 1963. *Zero tillage for corn following sod.* Agron. J. 55:207-208.
5. Johnson, W. H., and G. S. Taylor. 1960. *Tillage treatment for corn on clay soils.* Trans. Am. Soc. Agr. Engr. 3:4-7.
6. McAdams, W. N., and O. W. Beale. 1959. *Wheel-track planting in mulch and minimum tillage operations.* In *Proceedings, Association of Southern Agricultural Workers.*
7. McAlister, J. T. 1962. *Mulch tillage in the southeast.* U. S. Dept. Agr., Leaflet No. 512. U. S. Govt. Printing Office, Washington, D. C.
8. Moody, John E., G. M. Shear and J. N. Jones, Jr. 1961. *Growing corn without tillage.* Soil Sci. Soc. Am. Proc. 25:516-517.
9. Poynor, R. R. 1950. *An experimental mulch planter.* Agr. Eng. 31:509-510.
10. Rao, A. A. Swamy, R. C. Hay and H. P. Batement. 1960. *Effect of minimum tillage on physical properties of soils and crop response.* Trans. Am. Soc. Agr. Engr. 3:8-10.